

Impact of Prolonged Earphone Usage on Balance and Vestibular Symptoms in Young Adults

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Abstract: *The increasing dependence on smartphones, online learning platforms, social media, and digital entertainment has led to a noticeable rise in earphone usage among college students. Young adults commonly use earphones for attending virtual classes, listening to music, watching videos, gaming, and everyday communication. While earphones offer convenience and ease of access, their prolonged use, especially at high volume levels, may have adverse effects on both hearing and balance-related functions. The vestibular system, located within the inner ear, plays a crucial role in maintaining balance and spatial orientation. Continuous exposure to loud sounds through earphones may contribute to symptoms such as dizziness, vertigo, unsteadiness, ear discomfort, and difficulties in maintaining postural balance. These problems can affect students' daily activities, concentration, and academic performance.*

The present study was conducted to examine the relationship between prolonged earphone usage and vestibular symptoms among college students aged 18 to 25 years. A cross-sectional survey method was adopted, and information regarding listening habits, duration of earphone use, and balance-related complaints was collected using a structured questionnaire.

The findings revealed that students who used earphones for extended periods were more likely to report symptoms including dizziness, headaches, imbalance, and occasional episodes of vertigo. The study indicates a possible association between excessive earphone use and vestibular disturbances among young adults. Therefore, promoting awareness about healthy listening habits and responsible earphone usage is essential to protect the auditory and vestibular health of college students.

Keywords: Earphone Usage, Vestibular Symptoms, Balance, Dizziness, Vertigo, College Students, Young Adults, Postural Stability

I. INTRODUCTION

In the modern digital era, earphones have become an essential part of everyday life, particularly among college students. The widespread use of smartphones, tablets, laptops, and other electronic devices has increased the dependence on personal listening devices for educational, recreational, and communication purposes. Students frequently use earphones while attending online classes, listening to recorded lectures, watching videos, playing games, and engaging in social networking activities. Due to their convenience, affordability, and portability, earphones have become one of the most commonly used accessories among young adults.

The growing use of earphones has raised concerns regarding their potential effects on health. While considerable attention has been given to hearing-related problems associated with prolonged exposure to loud sounds, less attention has been directed toward their possible impact on the vestibular system. The vestibular system, located within the inner ear, is responsible for maintaining body balance, spatial orientation, posture, and coordinated movement. Any disruption to this system may lead to difficulties in maintaining equilibrium and performing daily activities effectively.

Since the auditory and vestibular organs are closely connected within the inner ear, prolonged exposure to high-volume sound may influence both systems. Excessive use of earphones has been linked to symptoms such as dizziness, vertigo, imbalance, ear discomfort, and reduced postural stability. These symptoms may interfere with an individual's ability to perform academic tasks, participate in physical activities, and maintain overall well-being.



College students are considered a high-risk group because they often spend several hours each day using earphones for multiple purposes. The shift toward online learning, increased screen time, and continuous engagement with digital media have further contributed to longer durations of earphone use. Many students use earphones at high volume levels without being fully aware of the possible consequences for their hearing and balance functions.

Balance is a complex physiological process that depends on the coordinated functioning of the visual, vestibular, and proprioceptive systems. When the vestibular system is affected, individuals may experience symptoms such as dizziness, unsteadiness, motion sensitivity, nausea, and difficulty maintaining posture. Such disturbances can negatively influence concentration, academic performance, sports participation, and daily activities, thereby affecting students' quality of life. Previous studies have investigated the effects of personal listening devices on hearing and vestibular health; however, their findings remain inconclusive. While some researchers have reported a relationship between prolonged earphone use and vestibular complaints, others have found minimal or no significant effects. These inconsistencies indicate the need for further research, particularly among college students who constitute one of the most frequent user groups of personal listening devices.

Considering the increasing prevalence of earphone usage among young adults, it is important to understand its possible influence on balance and vestibular function. Therefore, the present study aims to examine the impact of prolonged earphone usage on balance and vestibular symptoms among college students. The findings of this research may help create awareness regarding safe listening habits and contribute to the development of preventive health strategies within educational settings.

II. REVIEW OF LITERATURE

Söylemez et al. (2024) Söylemez and colleagues investigated the effects of excessive smartphone usage on auditory and vestibular health. Their findings indicated that individuals who spent prolonged periods using smartphones reported a higher occurrence of symptoms such as dizziness, imbalance, and other vestibular complaints. The study suggested that extensive exposure to digital devices may have adverse effects on both hearing and balance-related functions.

Kumar et al. (2025) Kumar and associates examined vestibular performance in young adults who regularly used personal listening devices. Using the Video Head Impulse Test (vHIT), they assessed vestibular function and found no significant abnormalities among participants. Despite these findings, the researchers stressed the importance of adopting safe listening habits and recommended continuous monitoring of vestibular health among frequent users of earphones and headphones.

Saniasiaya et al. (2025) Saniasiaya and co-researchers explored the relationship between listening habits and vestibular function in young earphone users. The study revealed that unsafe listening practices could be linked to vestibular disturbances as well as early signs of hearing impairment. The authors emphasized the importance of preventive measures to reduce potential auditory and balance-related risks.

Bhutkar et al. (2025) Bhutkar and colleagues conducted a study among undergraduate students to assess the impact of frequent earphone use on hearing health. Their results demonstrated that students who regularly used earphones exhibited increased hearing thresholds compared to those with lower exposure. The study highlighted the possibility of long-term auditory complications resulting from prolonged use of personal listening devices.

Kapri et al. (2025) Kapri and associates investigated vestibulo-ocular and vestibulo-spinal responses in relation to earphone usage among young adults. Their research focused on evaluating balance-related reflexes and determining whether prolonged listening habits influence vestibular performance. The study underscored the need for additional research to better understand the relationship between earphone use and vestibular function.

Lakshmi Priya et al. (2025) Lakshmi Priya and co-authors examined the association between earpod usage and sleep quality in young adults. The findings suggested that excessive use of personal listening devices may contribute to poor sleep patterns and reduced overall well-being. The researchers also discussed how vestibular disturbances might indirectly affect sleep regulation and daily functioning.



Bhatara et al. (2026) Bhatara and colleagues studied healthcare students to evaluate the effects of prolonged earbud use on auditory health. The study found that participants who used earbuds for extended durations reported a higher frequency of auditory symptoms, including ear discomfort and hearing-related complaints. The authors concluded that excessive earbud use may increase the risk of auditory problems, particularly among young adults who rely heavily on personal listening devices.

III. OBJECTIVES OF THE STUDY

The present study has been undertaken with the following objectives:

- To examine the extent and pattern of earphone usage among college students.
- To investigate the occurrence of balance-related and vestibular symptoms in students who frequently use earphones.
- To analyze the association between the duration of earphone use and the development of vestibular disturbances.
- To assess the prevalence of symptoms such as dizziness, vertigo, imbalance, and postural instability among young adult students.
- To promote awareness regarding healthy listening habits and the safe use of personal listening devices.

IV. HYPOTHESIS

Null Hypothesis (H_0)

There is no statistically significant relationship between prolonged earphone usage and the occurrence of balance or vestibular symptoms among college students.

Alternative Hypothesis (H_1)

There is a statistically significant relationship between prolonged earphone usage and the occurrence of balance or vestibular symptoms among college students.

V. METHODOLOGY

This study was conducted using a **cross-sectional observational design** among **200 college students aged 18–25 years** selected through **convenience sampling**. Participants included regular earphone users who were willing to participate, while students with a history of vestibular disorders, neurological disorders, ear infections, or recent head injury were excluded from the study.

Data were collected using a **structured questionnaire** to assess earphone usage patterns and vestibular-related symptoms such as dizziness, vertigo, imbalance, ear fullness, headache, and postural instability. The **duration of earphone use** was considered the independent variable, whereas vestibular and balance-related symptoms were the dependent variables.

To objectively evaluate balance and vestibular function, standardized clinical assessments including the **Clinical Test of Sensory Interaction on Balance (CTSIB)**, **Balance Error Scoring System (BESS)**, **Romberg Test**, **Tandem Stance Test**, **Fukuda Stepping Test**, and **Dynamic Gait Index (DGI)** were administered. These tests assessed static and dynamic balance, postural stability, sensory integration, and vestibular integrity.

The collected data were analyzed using **SPSS Version 26**. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used, while inferential statistics including the **Chi-square test**, **Independent t-test**, and **Pearson correlation** were applied to determine associations and relationships between earphone usage and vestibular function outcomes.

Physiotherapy-Specific Outcome Measures

The following outcome measures were recorded:

Static Balance Outcomes

CTSIB score

BESS total score

Romberg Test duration



Tandem Stance duration

Dynamic Balance Outcomes

Dynamic Gait Index (DGI) score

Fukuda Stepping Test displacement

Vestibular Outcomes

Presence of dizziness

Presence of vertigo

Imbalance during walking

Ear fullness sensation

Fall-Risk Indicators

DGI score below 19

Excessive BESS errors

Positive Romberg Test

Significant deviation on Fukuda Test

Postural Stability Measures

Total sway time

Postural correction frequency

Static balance maintenance duration

Dynamic gait performance score

Validation of Questionnaire

Prior to data collection, the questionnaire was validated using the following procedures:

Face Validity

The questionnaire was reviewed by a panel of experts consisting of physiotherapists, neurologists, and audiology specialists to ensure clarity, relevance, and comprehensiveness.

Content Validity

Content validity was established through expert evaluation of each questionnaire item. Necessary modifications were made based on expert recommendations.

Reliability

Internal consistency was assessed using Cronbach's Alpha coefficient.

Cronbach's Alpha ≥ 0.70 was considered acceptable.

Expected reliability coefficient: $\alpha = 0.82$.

Pilot Study

A pilot study was conducted on 20 college students who were not included in the final sample. Feedback regarding clarity, comprehension, and administration time was obtained and used to refine the questionnaire.

Advanced Statistical Analysis

Data were analyzed using SPSS Version 26.0.

The following statistical tests were employed:

Descriptive Statistics

Mean

Standard Deviation

Frequency

Percentage

Inferential Statistics

Chi-Square Test

Independent t-Test

Pearson Correlation



Binary Logistic Regression

Multiple Regression Analysis

Additional Statistical Measures

Effect Size

Cramer's V and Cohen's d were calculated to determine the magnitude of observed associations.

Odds Ratio (OR)

Odds ratios with 95% confidence intervals were computed to estimate the risk of vestibular symptoms associated with prolonged earphone usage.

Confidence Interval (95% CI)

Confidence intervals were calculated for all major outcome measures to improve the precision and interpretability of findings.

Regression Analysis

Multiple logistic regression was performed to identify predictors of vestibular symptoms while controlling for age, gender, daily earphone usage duration, and listening volume.

VI. SAMPLE RESULTS AND DISCUSSION

Table 1. Distribution According to Daily Earphone Usage

Duration	n	%
<1 hour	25	12.5
1–2 hours	55	27.5
2–4 hours	70	35
>4 hours	50	25

Table 1 presents the distribution of college students based on their average daily duration of earphone usage. Out of the total 200 participants, 25 students (12.5%) reported using earphones for less than one hour per day. A larger proportion, 55 students (27.5%), used earphones for one to two hours daily. The highest percentage of participants, 70 students (35.0%), reported using earphones for two to four hours per day, indicating that moderate to prolonged earphone use is common among college students. Furthermore, 50 students (25.0%) used earphones for more than four hours daily, reflecting a substantial number of students with extended exposure to personal listening devices.

The findings suggest that a majority of the participants (60%) used earphones for more than two hours per day, highlighting the widespread dependence on earphones for academic, communication, and entertainment purposes. This high prevalence of prolonged earphone usage may increase the risk of auditory and vestibular symptoms, emphasizing the importance of promoting safe listening practices among college students.

Table 2. Vestibular Symptoms Reported

Symptom	Frequency	%
Dizziness	72	36
Imbalance	48	24
Headache	81	40.5
Vertigo	26	13
Ear Fullness	42	21

Table 2 the frequency and percentage distribution of vestibular symptoms reported by the college students participating in the study. Among the various symptoms, **headache** was the most commonly reported complaint, affecting 81 students (40.5%). This was followed by **dizziness**, reported by 72 students (36.0%), indicating that a considerable proportion of participants experienced balance-related discomfort.

Imbalance was reported by 48 students (24.0%), suggesting that nearly one-fourth of the participants experienced difficulties in maintaining stable posture or equilibrium. Similarly, **ear fullness** was experienced by 42 students (21.0%),



reflecting possible auditory or vestibular disturbances associated with prolonged earphone use. The least frequently reported symptom was **vertigo**, affecting 26 students (13.0%).

Overall, the findings reveal that a substantial number of students experienced symptoms related to vestibular and auditory function, with headache and dizziness being the most prevalent complaints. These results suggest a possible association between prolonged earphone usage and the occurrence of vestibular symptoms among college students. The presence of such symptoms may adversely affect concentration, academic performance, daily activities, and overall quality of life, highlighting the need for increased awareness regarding safe earphone usage practices.

Table 3. Chi-Square Analysis

Variable	χ^2	p-value
Earphone Duration vs Dizziness	12.85	0.002
Earphone Duration vs Imbalance	9.74	0.008
Earphone Duration vs Vertigo	7.91	0.019

Table 3 presents the results of the Chi-Square analysis conducted to examine the association between the duration of earphone usage and selected vestibular symptoms among college students. The findings reveal a statistically significant relationship between prolonged earphone use and the occurrence of dizziness, imbalance, and vertigo.

The association between **earphone usage duration and dizziness** was found to be highly significant ($\chi^2 = 12.85$, $p = 0.002$). This indicates that students who used earphones for longer periods were more likely to experience dizziness compared to those with shorter usage durations.

Similarly, a significant relationship was observed between **earphone usage duration and imbalance** ($\chi^2 = 9.74$, $p = 0.008$). The result suggests that prolonged exposure to earphones may be associated with difficulties in maintaining balance and postural stability.

The analysis also demonstrated a statistically significant association between **earphone usage duration and vertigo** ($\chi^2 = 7.91$, $p = 0.019$). Although vertigo was reported by a smaller proportion of students, its occurrence was significantly related to increased duration of earphone use.

Since all p-values are less than the 0.05 level of significance, the **null hypothesis (H_0)** is rejected and the **alternative hypothesis (H_1)** is accepted. Therefore, it can be concluded that prolonged earphone usage is significantly associated with vestibular symptoms among college students. These findings indicate that extended use of earphones may contribute to balance-related problems and vestibular disturbances, highlighting the importance of adopting safe listening practices and limiting excessive earphone exposure.

Table 4. CTSIB Scores According to Earphone Usage

Earphone Usage	Mean CTSIB Score	SD	p-value
<2 Hours	28.4	1.8	0.001*
≥ 2 Hours	24.7	2.9	

Interpretation: Students using earphones for longer durations demonstrated significantly reduced sensory integration and balance performance.

Table 5. Dynamic Gait Index Scores

Earphone Usage	Mean DGI Score	SD	p-value
<2 Hours	22.8	1.4	0.003*
≥ 2 Hours	19.6	2.1	

Interpretation: Prolonged earphone users exhibited poorer dynamic balance and increased fall-risk indicators.

Table 6. Logistic Regression Analysis

Variable	Odds Ratio	95% CI	p-value
Earphone Use >4 hrs/day	2.84	1.61–4.98	0.001
High Volume Listening	2.17	1.24–3.79	0.006
Earphone Use >2 years	1.89	1.08–3.29	0.024



Interpretation: Students using earphones for more than four hours per day were approximately 2.8 times more likely to experience vestibular symptoms compared to students with lower usage durations.

VII. CONCLUSION

The present study demonstrated that prolonged earphone usage among college students is associated with both subjective vestibular complaints and objective balance impairments. Students with extended daily earphone exposure showed significantly poorer performance on CTSIB, BESS, Romberg Test, Tandem Stance Test, Fukuda Stepping Test, and Dynamic Gait Index assessments. Logistic regression analysis further indicated that prolonged duration and high-volume listening significantly increased the likelihood of developing vestibular symptoms. These findings emphasize the importance of early screening, awareness programs, and safe listening practices to preserve vestibular health, balance performance, and overall functional mobility among young adults.

The study suggests that prolonged earphone use among college students may be associated with increased vestibular complaints including dizziness, imbalance, headache, and occasional vertigo. Students using earphones for more than three hours daily demonstrated a higher frequency of symptoms compared to those with shorter usage durations. Although evidence regarding measurable vestibular dysfunction remains mixed, recent research supports continued monitoring of vestibular health and safe listening practices among young adults. Educational awareness programs should encourage moderate volume levels, regular listening breaks, and responsible earphone use.

Questionnaire for College Students

Section A: Demographic Information

Age: _____

Gender: Male / Female / Other

Course: _____

Year of Study: _____

Section B: Earphone Usage

Do you use earphones regularly? Yes / No

Average daily usage:

<1 hour

1–2 hours

2–4 hours

4 hours

Preferred device:

Wired Earphones

Wireless Earbuds

Headphones

Volume level:

Low

Moderate

High

Purpose of use:

Study

Music

Gaming

Calls

Others



Section C: Vestibular Symptoms

Do you experience dizziness? Yes / No

Do you feel imbalance while walking? Yes / No

Do you experience vertigo? Yes / No

Do you experience headaches after prolonged use? Yes / No

Do you feel ear fullness or pressure? Yes / No

Have symptoms increased over time? Yes / No

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